# Development of the electric shock prevention transparent cover for infrared thermography diagnosis

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## 1. Technical Summary

- Classification; 2 – A, 2 - C
- The infrared thermography diagnosis is applied to confirm the condition of the hot-line electric equipment without touching the object to be measured. Particularly, the difference of thermograph suggests the abnormality such as the poor contact or the current imbalance of the electric equipment. The infrared thermography diagnosis is one of the most effective methods to detect the abnormality of the apparatus by monitoring the difference of the thermograph. At nuclear power plants in Japan, the transparent resinous protective covers are applied to the exposed live parts of the electrical equipment, the purpose of which is for prevention of the electric shock and even as for visual inspections. However, any existing transparent resinous covers don't have the transparency against infrared rays. So we couldn't apply the infrared thermography diagnosis to the electrical equipment through the transparent resinous covers. Against a background of these, we developed the transparent resinous cover which could be applied to the infrared thermography diagnosis as well as the electric shock prevention and the visual inspections.

## 2. Development Phase

(1) Phase 1 ✓(2) Phase 2 (3) Phase 3

## 3. Scope

- Components : Electrical equipment
- Location : Protective covers for the exposed live parts, In air
- Materials : Polyolefin covered on electrical equipment
- Condition : ---

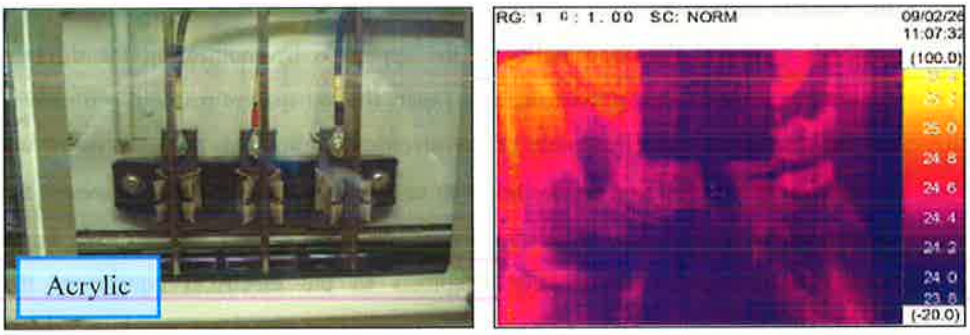
## 4. Features

### 4.1 Effectiveness and problems of infrared diagnostics for the electrical equipment

We applied infrared thermography diagnosis with the infrared thermography camera which can confirm safely the fever point that is difficult to measure directly such as the high place and live parts. The fever point caused by poor contact of the electrical equipment can be easily found by using infrared thermography diagnosis.

On the other hand, at nuclear power plants in Japan, we install the protective covers made of transparent resin in front of the exposed live parts to prevent an electric shock. Both the visual inspection and the thermography diagnosis could be applied to the electrical live parts safely without electric shock by electric equipment, if transparent protective covers which could transmit infrared rays had been developed.

However, any transparent platy resinous covers such as acrylic did not have the transmittivity for the infrared rays. (Fig.1)

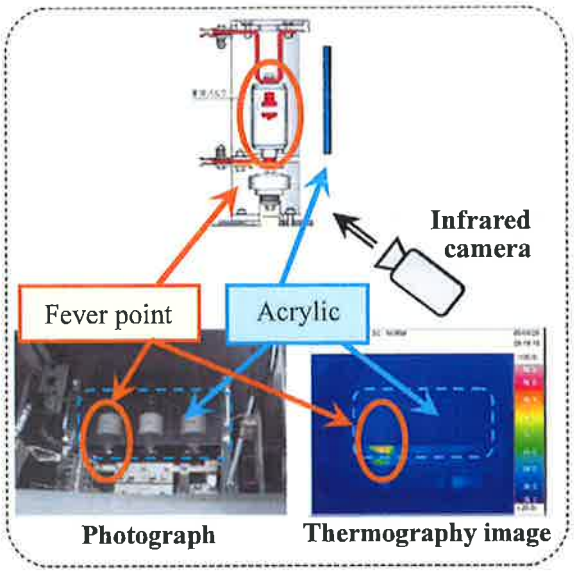



**Photograph** **Thermography image**

**Fig.1 Influence of acrylic plate on infrared thermography diagnosis**

When we had to apply the infrared thermography diagnosis to electrical equipment, we carried out the infrared thermography diagnosis through the gap between the acrylic cover and the electric panels.

We couldn't investigate the most of the fever points because of the narrow gap. (Fig.2)




**Photograph** **Thermography image**

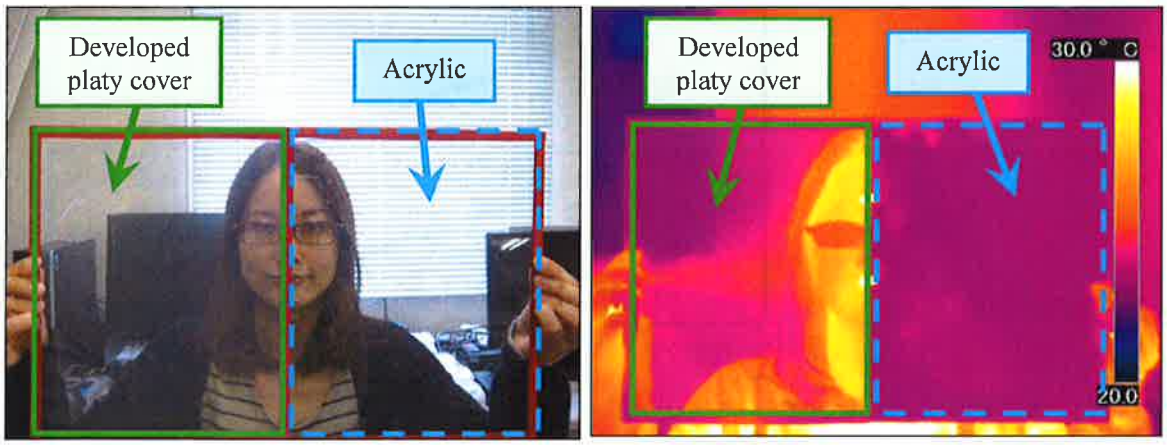
**The work situation**

**Fig.2 Conventional measurement situation**

4.2 Development of the electric shock prevention platy cover transmittable for the infrared rays

The Japan Atomic Power company has developed the platy resin cover that can transmit both infrared rays and visible rays with electrical insulation property for electric shock prevention. The developed platy cover made with transparent material and it transmits infrared rays.

We compared the developed cover with the acrylic cover. We can find definitely that the developed platy cover made with transparent material transmits the infrared rays. (Fig.3)




**Photograph** **Thermography image**

**Fig.3 Comparison of the transmittivity of the infrared and visible rays of the developed platy cover with acrylic**

In addition, the electrical insulation property and the melting point of the developed cover are better than those of the acrylic cover. (Table 1)

However, when it exceeds 80 degrees Celsius, the developed cover softens and transforms. We recommend that the developed cover is used in environment less than 80 degrees centigrade.

But in a practical sense we use most of the electric equipment with less than 80 degrees. Therefore the developed cover would not have the heat-resistant problem mentioned above.

**Table 1 Comparison of characteristics of the developed cover with acrylic**

| item | Developed cover | Acrylic |
|---|---|---|
| Volume specific resistance (Ωm) | $5.0\times10^{15}$ | $<10^{15}$ |
| Breakdown voltage (kV/mm) | 74.7 | 17.7～21.6 |
| Melting point (℃) | 120 | 90～105 |

4.3 Laboratory test

We simulated poor contact by installing the resistance in a terminal stand of black electric wire (right side) shown in Fig.4 and we installed the protective cover on this circuit. The accurate temperature was measured through the protective cover as the emittance of infrared ray . (Fig.4)

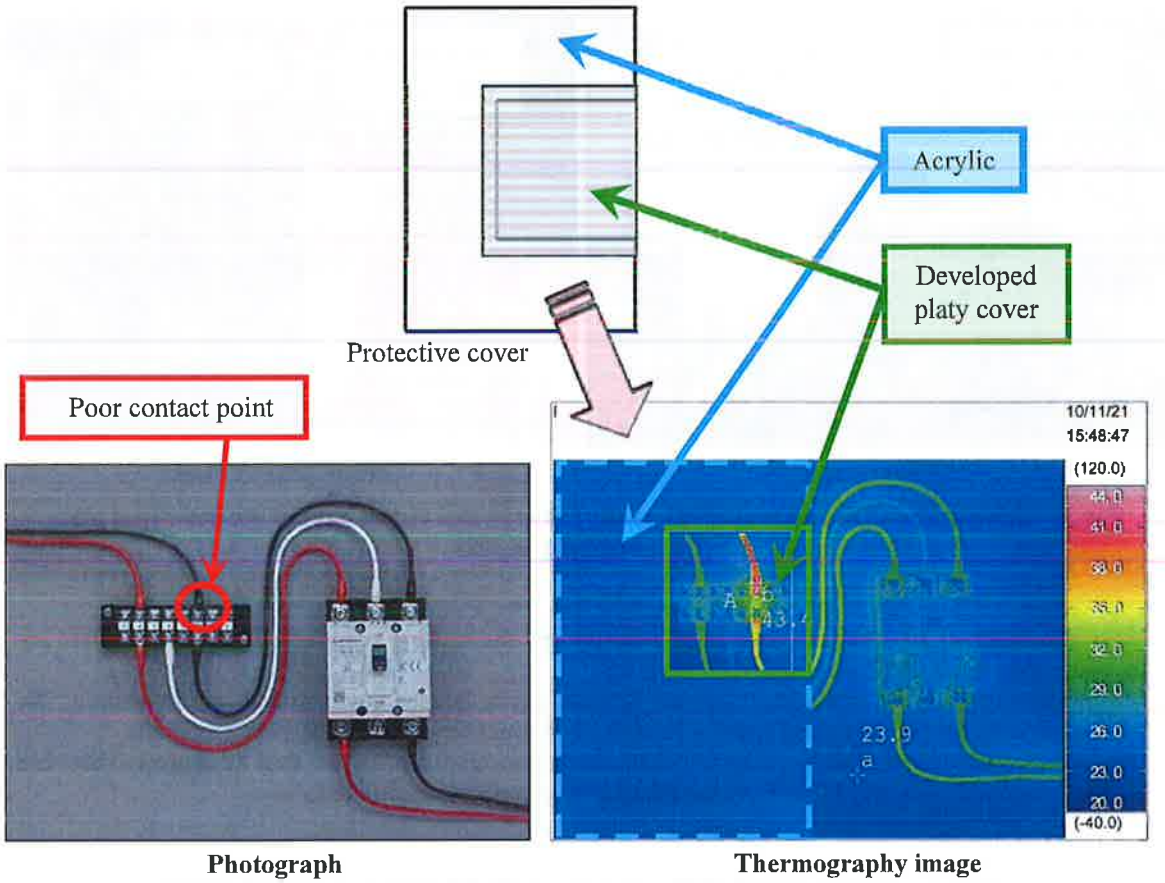
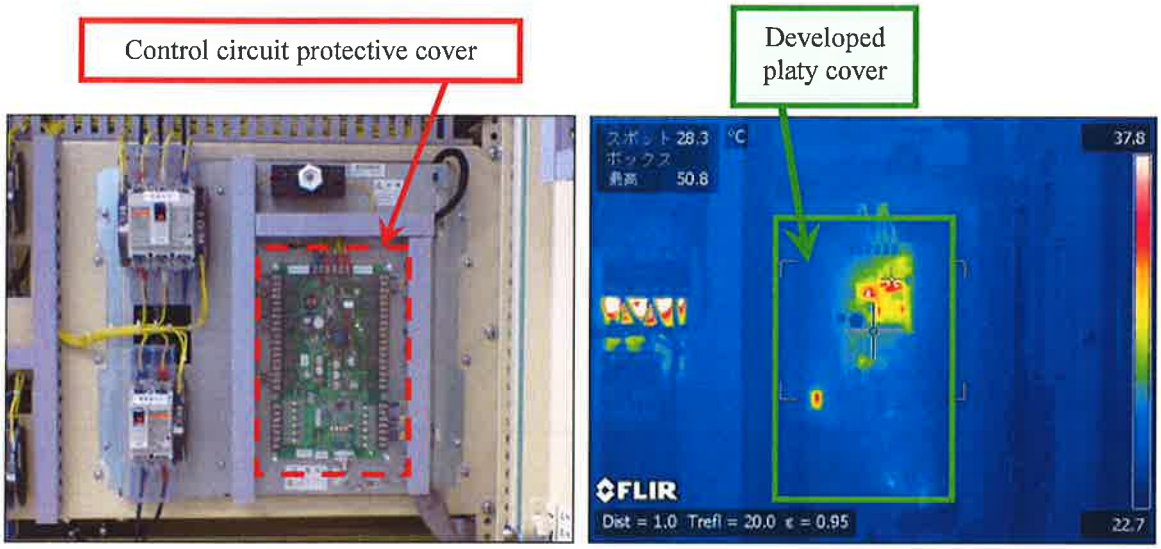



**Fig.4 Laboratory test**

## 5. Example of Application

This is the example which is used for control circuit protection with the developed cover. Even if a protective cover was installed on the circuit, we enabled the data taken as the infrared thermography diagnosis.

In this example, we were able to confirm definitely the temperature of circuit parts was 50 degrees Celsius. (Fig.5)




**Photograph** **Thermography image**

**Fig.5 Example of the thermography image of the control circuit through the developed platy cover**

This platy resinous cover applied to the control circuit protective cover enables the infrared thermography diagnosis as well as the electric shock prevention and the visual inspections.

Even if the electric equipment is in service, workers can investigate electric equipment through the developed cover by infrared thermography and can work safely without electric shock. And we can detect the degradation of the electrical equipment precociously and loose terminal to maintain.

We use this developed cover both for worker's safety and for our electric equipment safety.

The Japan Atomic Power Company can send a sample of the developed cover. And, we can provide the developed cover for sale. Please contact us to improve on-site work.

## 6. Reference


- S.Shiramatsu and K.Yonezawa, Development of a Transparent Insulating Protective Cover that Enables Infrared Thermography Diagnosis, THE THERMAL AND NUCULEAR POWER, 6 (2014) (In Japanese)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